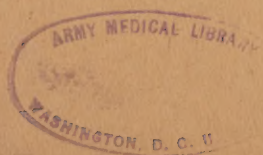


ARMY AMPUTATION CONFERENCE 1 - 3 August 1945

CONFERENCE OPENED 1000 1 AUGUST 1945 AT ARMY MEDICAL CENTER

PRESENT

Colonel Leonard T. Peterson, M.C.	-Office of The Surgeon General
Colonel Mather Cleveland, M.C.	-Office of The Surgeon General
Major Robert S. Pirie, MAC	-Office of The Surgeon General
Captain William W. White, MAC	-Office of The Surgeon General
Colonel Alfred R. Shands, M.C.	-Office of The Air Surgeon
Captain James Vernon Luck, M.C.	-Office of The Air Surgeon
Lt. Colonel W. H. McGaw, M.C.	-Walter Reed General Hospital
Captain James A. Carnes, M.C.	-Walter Reed General Hospital
Lt. Richard Billings, MAC	-Walter Reed General Hospital
Major Rufus Alldredge, M.C.	-England General Hospital
Captain Calvin Terwilliger, M.C.	-England General Hospital
Lt. Colonel Ed. C. Holscher, M.C.	-Lawson General Hospital
Lt. Colonel Ernest Myers, M.C.	-Bushnell General Hospital
Major Gene Caldwell, M.C.	-Percy Jones General Hospital
Major Clinton Compere, M.C.	-McGuire General Hospital
Major Harry D. Morris, M.C.	-McCloskey General Hospital



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Meeting 1 August 1945

Peterson: Gentlemen, the conference will come to order. First I want to announce everyone present so you will be acquainted. (Introductions) Col. Wintermute is present to demonstrate a new type of crutch before we proceed to the subject of amputations.

Wintermute: I have here some new crutches that have attachable arm spring braces so that you don't have to change your crutch from one hand to the other when you open a door, or when you pick things up. It will collapse and come apart into three parts, the handle and two separate pieces, and fits into a small case. The tubing is aluminum, handle is made out of magnesium. They are very light and easily handled. This is the first pair made by Loftstrand Company, Silver Springs, Maryland.

Shands: Are they patented?

Wintermute: No sir. The only feature to be patented is the aluminum pieces. It is a German type copied and improved.

Peterson: Thank you, Colonel Wintermute, will you send a pair of the crutches, if the company will permit, to the Technical Division, Surgeon General's Office. We will now proceed to a discussion of prostheses. We will discuss fiber limbs this morning, beginning with Walter Reed, Lawson, Percy Jones, and McCloskey. First it might be well to look at the new knee joint which is going to be supplied in all types of AK limbs. I don't think most of you have seen it. The first one was sent to Atlantic City. This is the aluminum Centrifugally cast Hanger knee assembly. The knee is still heavy and changes are already being made which will make it about 30% lighter. The collar is 1 3/4 inches high for attachment of fiber and plastic. That is probably more than we need due to the fact that we are now able to get a better bond than first expected. We are in the process of having sections made up of various heights from 3/8 to 3/4 inch, with and without ridges, which are going to be bonded by the same technique and submitted to strength tests.

Billings: This is a new type of ankle assembly in the fiber limb. The above knee fiber limb is still furnished us with the Minneapolis Limb Company knee since we have not yet received the metal knee. We have found that the bonding material stood up well. In the first samples of the slipper foot the instep is a little thin so we built it up with felt. We understand that the foot is being increased in thickness. Some of these feet are being made of laminated wood and are proving to be very strong. We have had trouble with short abducted thigh stumps. We have some special abducted sockets from the Minneapolis Artificial

Limb Company. We tried building celastic sockets and the men find the celastic socket more comfortable, and would not trade them for anything. I found when I was at the Purchasing Department, that celastic is not available under the term "Celastic" but is available under "plastic impregnated fabric" at the St. Louis Depot.

Peterson: The Depot should carry the term of celastic in parenthesis in order to make this clear. The solvent for celastic is not listed separately because a standard item is satisfactory.

Allredge: We have used celastic very extensively for the past few months and there are one or two points of interest to be noted. The BK socket will get out of shape and tends to get smaller. The cotton fabric absorbs the moisture from the patient's stump, and this makes it shrink. Recently I saw a celastic socket which was painted with a liquid celluloid which when dry, looks exactly like celluloid. It makes the socket waterproof so it won't absorb moisture. It looked good and we are going to get some for trial. A few days ago at a meeting in Atlantic City, I talked to the DuPont representative and showed him the socket and how it definitely had changed shape. He was a little surprised to learn this, but thought if we made it a little thicker, it would not change shape. We are getting some material for coating to make this thing moistureproof.

Holscher: Would you recommend coating both outside and inside surfaces?

Allredge: Yes.

Billings: If you mix celluloid filings with acetone, you get the same agent. We have made a plastic socket here using a plastic solution to soak black felt, cured in a drying oven. It is very much like hard rubber with a smooth finish. We have enough plastic on order to make 300 sockets.

Peterson: Have you actually made a clinical test on it?

Billings: No sir.

Peterson: I think you should run a test on it and advise all the other centers of the results as a follow-up on this meeting. Mr. Nagy is to make a visit to all the centers and show the technique being used at Bushnell where they have been using plastic sockets for a considerable period of time and have found them entirely satisfactory.

Billings: We have a patient here to demonstrate something on shoulder disarticulations where we had a little trouble in cases with small chest expansion. (A harness attachment was demonstrated). He gets activation by chest expansion and it does not interfere

with breathing.

Peterson: Captain White, I believe we should advise the Chemold Company that the ankle assembly is too tight. They should check them carefully before sending out.

McGaw: I am sorry Major Slocum isn't here because he was going to show one type of boot prosthesis for a Boyd amputation. We thought some of you might be interested in this. (Patient enters). He received this only yesterday and this is his first day on it. He had the amputation on 13 April 1945. In this operation the talus is removed and the tibia fused to the os calcis.

Billings: This is a molded leather socket with three pieces of wood. The back piece of wood is glued to the leather bucket with glue, the others being hinged to allow foot action.

Peterson: Could this man walk without a prosthesis?

McGaw: He was in a walking plaster. He had a stump very similar to a Chopart's. We did no rigid bone grafting but some bone chips were put in.

Morris: At McCloskey we have done four in which we left the talus in and fused the ankle and subtalar joints. The stump is therefore a little longer than in the case shown here.

Peterson: Did they all fuse?

Morris: They all fused but the Achilles tendon was sectioned in the last three to avoid equinus deformity which developed in the first.

Peterson: This looks like a useful amputation. There are five cases of this type then, one here and four slightly different at McCloskey. I suggest that you make drawings of the prosthesis and send it to all amputation centers. Capt. Alldredge will now comment on the plastic limbs.

Alldredge: I don't have too much to say about plastic limbs because we just received them. We fitted our first BK about 7 or 8 weeks ago and since then we have tried a few but have not yet fitted plastic AK limbs although we got in a few for demonstration purposes. The plastic limb, has the thigh container separate which should come unbonded to the knee joint so we can rotate the leg in any direction to fit each case and then bond it. The AK socket is separate from the container and can be taken in for shrinkage and let out if necessary. The separate socket really fits the patient and it definitely has advantages.

Peterson: Can you make your own AK sockets of plastic?

Alldredge: Apparently, if there is difficulty with the AK thigh container and socket, it would be simpler just to discard the whole socket and container and make a plastic thigh socket. Fiber glass seems encouraging and can be molded to the individual case. In that connection, it is interesting to note that Woodhall uses a single one piece thigh socket. The man from the Chemold Company who has been sent to England General Hospital is an amputee and said he had been using it himself. This question has to be settled as it is an important feature.

Peterson: Major Alldredge, you can place an order for a number of the plastic thigh sections as single pieces and give them a trial if you like.

Morris: Is there any difference in weight compared to fiber?

Alldredge: I don't think so. This leg can be lightened.

Peterson: The ankle is provided in one size for metal, aluminum, and fiber legs. The knee will be standard in two sizes. We will now hear from Col. Holscher, Lawson General Hospital.

Holscher: Will grinding of the celastic socket result in fuzziness?

Alldredge: Yes. That is one of the problems. It does make the inside of the sock fuzzy and it detracts from the effectiveness of the socket because BK sockets should be as smooth as possible. That is exactly the trouble we had. We finally decided to coat the inside of the socket with celluloid paint.

Holscher: Another question, has anyone covered the socket with rawhide?

Billings: We have done one or two with horsehide and one with rawhide. It is a little hard to work it inside but the horsehide is very nice.

Holscher: We still have a problem in the fiber thigh piece. We can pull in the top but then we don't have a uniform fitting piece which is desirable and I am wondering if anyone has used celastic to build up the inside of the socket.

Alldredge: We have had the same difficulty and our men think they have the solution by filling the space with celastic particularly in the stump that is very large, and tapers to a very small end.

Peterson: Couldn't that problem be solved by the use of a separate socket?

Holscher: Yes, I believe so.

Peterson: Lt. Hanger states that he is not too enthusiastic about metal sockets even in metal limbs and he believes the answer to be a plastic socket and metal limb.

Holscher: Will this metal be available to centers for use in experimenting?

Peterson: It was our original plan that we try it at one center before adopting it on a wider scale.

Compere: We are using leather and want to use plastic sockets.

Holscher: Last fall some of you may have heard of the ball and socket joint developed in our shop to be used on bilateral arm amputees. Perhaps some of you saw Mr. McGonegal using one. We had a number of these fabricated but they have never been released because it still has some bugs in it; such as a positive fixation between the ball and socket, and the weight. We have a polycentric elbow joint which was first developed for elbow excisions where the soft tissue gets bulky on flexion. The double jointed affair works reasonably well on ordinary below elbow prostheses. Immediate results seemed good and we now have 12 in use, most of them by request.

Peterson: I would like for you to give it a trial and advise the centers of your experience. If it proves to be a good joint, we will endeavor to secure it for all since it has possibilities. It would be well to mention here the Northrup rotary wrist joint which McGonegal is wearing in his travel to all centers. We wrote to Mr. Northrup and suggested that, if he felt the joint was satisfactory, it should be in production. He stated that he had taken the wrist joint apart and was pleased with its performance. The Supply Service is entering negotiation on this joint but it will take some time for quantity production. The above elbow joint is receiving considerable attention at Northrup. We plan to send all bilateral Above Elbow cases to Pasadena for fitting by Northrup, using the new joint. After these have been tested, we hope this joint may also be put into production.

Holscher: When Mr. McGonegal was with us about three months ago, he was having irritation on the end of the stump and was developing a bursa as a result of the rotary wrist mechanism. He wasn't using any kind of sock around the end of the stump. We suggested that he wear some type of sock to reduce friction and that adhesive tape might help.

Compere: Will the disarticulations of the wrist develop a bursa?

McGaw: No; there is only one thing -- the prosthesis may slip.

- Peterson: Major Caldwell, do you have anything to add to the discussion?
- Caldwell: We have been using fiber legs entirely and have been using celastic to make sockets. We grind it down and it gets fuzzy but we haven't done anything about it. I have a question about a double arm amputee or bilateral leg amputee who is blind. Is he going to be able to walk with prostheses? Is it worthwhile to fit him? Will he have any sensation and know where he is putting his feet?
- Peterson: I think you should fit him so he can learn his way around. Major Morris, any comments?
- Morris: We have been troubled with the very short BK and BE stump. We have had 15 cases where the stump was revised and a one inch section of biceps tendon was taken out of the tendon. We then fit them with a satisfactory below elbow prostheses and the men are very well pleased. We have been trying the same technique with the short BK stumps and the few cases we have done are getting along OK. In these cases a section is cut out of the hamstring tendons.
- McGaw: I have one very short below elbow stump in which we transplanted about $1\frac{1}{2}$ inches of the radius onto the ulna to lengthen the stump and he has good function.
- Peterson: The procedure described by Major Morris in very short BE and BK stumps sounds good. He should keep track of these cases and make a complete report at a later date. If there is no further business we will now adjourn until this afternoon.

Recessed for Lunch

A film was shown by Captain Carnes, on the operative technique of BK amputations as performed at WRGH. Three cases were then presented showing BK amputations which had been performed by the technique as shown in the film.

Colonel Peterson suggested that it should be made clear in the narration whether a tourniquet was used, the fibula might better be shortened extraperiosteally and not subperiosteally as shown and sharp dissection would probably be better than blunt dissection in reflecting the flaps. The new standard pneumatic tourniquet was discussed. Any defects which might occur should be called to the attention of the Technical Division of The Surgeon General's Office.

The question of fascial closure was then discussed. The four centers McGuire, McGloskey, Lawson, and Percy Jones all close fascia separately whenever possible in amputation or revision. Walter Reed and England are not using fascial closure but simply skin closure over the bone. (Bushnell representative had not yet arrived). Major Compere,

McGuire General Hospital, said that they were starting to perform their amputations with the patients lying on the stomach except for short BK amputations which were performed with patient lying on his back. All BK amputations are performed routinely at Lawson with patient lying on stomach. The other amputation centers are performing routine BK amputations with patient lying on his back.

Holscher: I suppose results by the various techniques will be the same. We feel that early fitting of a prosthesis demands the removal of a good deal of terminal soft tissue, muscle, fascia and aponeurosis to prevent the cylindrical type of stump. I believe there is a lot of tissue that has to undergo metaplasia and you might as well get it all out in the first place. We have been doing the operation with the patient in a prone attitude. In fact, if you don't have them in that attitude you are going to a lot of trouble. With this position you have the stump end up. In cutting the bevel of the tibia you make the cut first and then the bevel. There is a lot of muscle proximal to the saw cut which we skive out down to the tibia. We then cut out excess muscle and sew up tight with no drains, putting on a full cylindrical cast - it heals in three to four weeks. We use a spica on a thigh which will heal in about 4 to 5 weeks. As a rule we do not use drains.

Peterson: It is the policy at Lawson not to drain and at the other centers to drain the amputation stumps postoperatively.

Compere: We are using elastic compression dressing with a sugar tong plaster splint. We take the drains out in 48 hours. The patient is a bed patient for about 14 days. When operating with the patient prone and with the knee flexed, you have to be careful or there will be too much tension on closure unless allowance is made for the change from flexed to extended position.

Holscher: The leg should be in extension when sewing the skin edges. The fibula, we feel, should be extraperiosteally.

Morris: How long is the operating time?

Holscher: It can be done in about 1-1/4 hours.

Allredge: As for closing the skin over the fascia, I have tried both ways. It takes a more highly skilled surgeon to do the fascial closure.

Peterson: Does this apply only to BKs?

Allredge: Only to BKs. On thighs, I think it is very well to close the fascia. Certainly the simple skin flaps have been on the whole satisfactory. I used to think that when the suture line

broke down after fitting, it might be the fault of the method of operation but I am now convinced that is not the case. The patients are improperly fitted in the majority of cases when the scars break open. The scars won't break down if patients are properly fitted. I believe flaps should be equal in length and I think 5" to 7" is the best length for a stump. One should consider the circulation, of course and also the height of the patient. If circulation is impaired, he should not have more than a 5" stump. A lengthy stump is too hard for the fitter to fit properly. I believe sharp dissection is preferable to blunt dissection. After the length of the stump has been determined, the skin is marked at the tibial crest, the diameter and radius determined. The flaps should be $\frac{2}{3}$ of the length of the radius, the anterior flap the same length as the posterior. This places the scar in the center of the end of the stump, which is the only place where there is no pressure. Make a superficial incision right in the center and then outline the flaps. You have the same amount of circulation in the posterior as in the anterior flap. Relative to the patient's position, prone or supine, when I first started out I thought the prone position was best but now I never put one face down. I think operating should be done in the same position as the patient will occupy in bed. I tried both with and without drains. Now I drain all of them. Of course, if we can get them dry enough, we don't need drains. Proper splinting is far better, even when the skin is tight, in a BK stump than the use of skin traction.

Peterson: Are you all opposed to skin traction postoperatively?

Compere: Once in a while I have felt that skin traction was the only thing to use.

Allredge: I believe that traction definitely cuts off circulation. Immediately postoperatively, if the skin is too tight traction should not be used.

Compere: The main trouble is in not having people with enough experience to put it on. It can be used effectively, but should not be used immediately postoperatively.

Allredge: I still believe proper splinting is better than traction. We have operated with and without draining and believe now that it is better to drain them all. I don't believe it does any harm. No subcutaneous sutures are used. The stump is wrapped with bandage and a sugar tong splint applied, the stump kept elevated two weeks. The patient is kept in bed 4 weeks. A BK amputation is the real test of a surgeon. Many stumps may be cleanly healed in 2 weeks and you let the patient up and two weeks later he will start draining. We feel dependency is the cause of this. We keep them in bed 4 weeks

and find the results are better. Don't even give them bathroom privileges. I think they heal better and stay healed if kept in bed for four weeks.

A movie produced at Walter Reed was then shown illustrating how one amputee trained himself to walk, run, play golf, swim, etc. The amputee, Mr. Bura was present.

Bura: I was about 25 when I lost my leg.

Morris: Do you change the adjustment in your knee at any time? If you want to run, do you tighten up the knee?

Bura: No. I have been to several Army hospitals and believe there is a need for standarizing walking programs. Most people never pay any attention to certain things when they walk. There is only one position for the foot if you are to maintain perfect balance, that is with the feet close together. The normal leg is flexed somewhat in walking whereas an AK prosthesis is in the straight position; therefore, it lengthens the stride on that side about 2". The foot should be kept as close to the floor as possible. I drag the toe a little purposely each day so that I know where the foot is and can keep the heel of the prosthetic foot as closely as possible to the ground. It is wonderful exercise in developing "feeling" in the artificial foot.

Holscher: Your legs are of equal length?

Bura: Yes. I find at times that the stump sock tends to become thickened when washed, which makes the leg a little longer temporarily, but after walking on it for a few minutes this flattens down. There are three requisites: balance, keeping the feet as close to the ground as possible, and equal uniform length of stride.

Bura then brought in three patients as exhibits.

Bura: First exhibit has the leg off about 3" above the knee. Has been walking about 5 months. Tends to lift leg too high, causing an outward movement to the prosthesis. Second exhibit is a mid thigh amputation. Has been walking about 5 months. Has practically no limp. Has been practicing walking a straight line, keeping feet close together. The third exhibit is an AK. Has had leg only three days. Still walks with crutch.

Peterson: I believe, Mr. Bura, that you could do a lot to help the various amputation centers.

Bura: I think each individual amputee offers a different personality. Each walks somewhat differently. I would rather take 2 men

for 15 minutes at a time and then let them go off for a week and practice by themselves. In a group you have various kinds of amputees and you can't pick out their faults in group training.

Peterson: Some more uniform and concentrated program would be worthwhile. There are two things I think any instructor has to do - make certain allowance for the habits the various centers may have been following and allow for the difference between the prosthesis we are using and what you are wearing. I want to thank Mr. Bura and will see him later to make arrangement for visit to all centers as a consultant.

Billings: When you saw yourself walking in a movie did it help you correct any of your faults?

Bura: I hadn't seen the movie before. I watched various nonamputees walk and knew that I would have to do things like they did if I were to walk normally. I learned to place the heel on an imaginary line. If a nonamputee can simulate the walk of an amputee, I figure that the amputees walk the way they do because of certain motions they do wrong.

Peterson: A representative of the Red Cross called recently to say he had heard that swimming was not advised for amputees. There is no directive to that effect. We have encouraged swimming, and wish you would trace down and report any rumors to the contrary.

We will give Captain Carnes a few minutes in which to make a rebuttal to the comments on his movie.

Carnes: First, the movie had entirely to do with reamputations. We don't worry about tight flaps when we do amputations correctly. We use a tourniquet. The average operating time is 30 minutes. As for the question of blunt dissection of flaps, if you have a good tissue plane you can reflect it back without any trauma. Many surgeons do it in a herniorrhaphy for instance. Relative to the periosteum on the fibula: Actually more is removed than was demonstrated by the movie. Surrounding the fibula there is a large plexus of veins which are easily broken into if you go extraperiosteally and the trauma makes a great deal of suturing necessary. On the question of the fascial flap, I see no advantage or disadvantage. In suturing, we have used No. 60, 80 and even 120 cotton. We have had trouble with the quilting cotton even 6 to 8 months later. Lately I have been using 00 chromic, and we would like to use 000.

Peterson: How many centers are using cotton for the subcutaneous suturing?

Allredge: Our ligatures are cotton.

Holscher: We are using silk and catgut.

Morris: McCloskey is using subcutaneous sutures of cotton.

Compere: We are using 00 chromic on the fascia and 00 plain for ligatures. Recently we have been using cotton and I think the results are better than when we used the larger chromic.

Carnes: We use drainage routinely. I have spent as much as an hour trying to get them dry and even then we had hematoma formation. As to pressure splinting, a year ago we were using sugar tong plaster. Our operations increased so that we gave up this method and used an ordinary posterior board splint and bandage on the leg and the results are better. As far as the prone position is concerned, I have tried that and don't like it.

All visitors were excused and the official representatives reassembled. Colonel W. J. Renn, from Research Division, ASF, and Lt. Colonel L. H. Warren, Research Coordination Branch, SGO, joined the conference.

Peterson: The principal reason for calling this conference was to outline a specific research program. You know we have made considerable changes and progress in the amputation program in the last few months but the improvements have not been designated as research. We are now directed to outline specific projects by August 15th. I will read you the directive from Headquarters, Army Service Forces, which furnishes the basis for this program. (Col. Peterson then read directive.)

The Committee on Prosthetic Devices has just recently been established. I have gone over this subject with the Committee and I believe we can reconcile this directive with the efforts of that group. In order to make the program entirely clear, I have prepared a brief report entitled "Status of Research on Artificial Limbs," and a tentative program for Research and Development. (Col. Peterson then read reports.)

Participation of the various centers in a research program should depend on geographic location, availability to industrial centers, etc. Some centers are already doing special types of work and priority should go to them. Colonel Scheumann, Chief of the Dental Service of AMC, will show you a cosmetic glove he has been experimenting with.

Scheumann: This is a cosmetic glove to be used in covering up the hand so it will not be so noticeable. We investigated and found a plastic which showed considerable promise - called Dermaflex. We got some and produced a hand, but we could only get a little material and had to carry out all experiments as to permanency and color with the one sample hand. We exposed it to sunlight

for over a month and the color remained true for three weeks and then started fading and faded very quickly from then on. We haven't been able to get any more material to experiment with so far. It could be used either as a glove or build over an appliance.

Peterson: Thank you, Col. Scheumann. At this point I wish to call on Col. W. J. Renn, Research Division, ASF, and Lt. Col. L. H. Warren of the Research Coordination Branch, Surgeon General's Office for general orientation on Army Research Projects.

Renn: The Under Secretary of War sent a letter to General Somervell suggesting that the SGO have a research program. Consideration of the work that has been done by the Committee on Prosthetic Devices should be given in the projects in the SGO. There is a strong possibility of discontinuance of OSRD, which was set up as a war measure. If the OSRD did fold up, at the present time there is no definite arrangement for anyone to take over that work and that would leave the SGO high and dry. I feel there is plenty of work to be done in connection with prosthetic devices outside of the work being done by the Committee. The outline of the projects to be done at the various hospitals is very good, as they can be done to implement the work of the Committee. We had no intention of duplicating the Committee on Prosthetic Devices, but only to help them. Setting up these projects is the best way to get funds and personnel for carrying on the work. This project would be a postwar project.

Peterson: That raises another question.- We will lose our amputees after the war and without them the project will lose its punch.

Renn: True, but you should be able to work along with the Veterans' Administration.

Peterson: Not unless we can get the amputees returned to us. I believe we should have some of them return to the Army amputation centers if we are to conduct long term research.

If the program is approved, will we get money and personnel without further request? How can each center get additional personnel.

Warren: That would be done centrally in The Surgeon General's Office. We would recommend to the Personnel Service that officers be assigned to each center for that purpose, citing the project as approved. As you said, the program has been going on in the past, but has been informal and it now becomes necessary to be more formal. As I see it, this is actually a program and will be composed of separate projects. In the Technical Division of the SGO we have to get formal approval of funds

and projects requested by the orthopedic consultant and once having had that we inform our Fiscal Division and ask them to allocate the funds where they would do the most good for the various projects. Considerable money should be allotted to The Army Medical Purchasing Officer as well as to the amputation centers mentioned today. Actually, each amputation center will function separately and we will allot the funds. Monthly reports will be requested. It will be my job to enter the progress on all research and development projects. Another report will be submitted monthly to the Research Division of ASF, giving the over-all picture on progress of the program. We will probably ask a special report on each project. We would like to have these in duplicate so we can keep one in each separate file and one as a whole. The Supply Service, is going to help on prices, supplies, etc.

Peterson: Is there any danger of War Department funds being curtailed?

Renn: A long range program is being outlined on the basis of at least 5 years after the war.

Peterson: May I have any suggestions or comments as to the projects outlined for the various centers.

McGaw: I think you have drawn up a very comprehensive picture and the tentative outline sounds very good to me. I think there are several small projects that the separate centers are interested in. There may be some overlapping. We have been very much interested in the problem of gait - how the artificial limb and the patient get along together.

Peterson: Part of the contract with Northrup under the Committee on Prosthetic Devices concerns gait and anything along that line would be a duplication.

McGaw: I feel that the project you have given us is a very complicated one and I think we need more personnel, such as a chemical engineer. We should be able to call on any of the men we need in each field.

Peterson: You will have to keep in mind that full-time engineers will be hard to get. You should, however, submit an estimate for your needs. Col. Warren, will it be necessary to list the personnel for each project?

Warren: I think we should have an over-all estimate. In the case of personnel, I think it best to request the personnel now needed but not restrict yourself for future needs. This is a program of research and it would be best to specify each individual project by name.

Peterson: In other words, call the whole thing a program and the individual parts projects?

Major Morris, can McCloskey handle any projects?

Morris: In our situation we are not in an industrial center to establish good industrial connections. The thing we feel is probably neglected as much as anything else is prostheses for partial feet and I still feel some suitable prosthesis for Chopart's amputations deserves attention.

Peterson: Would you like to undertake a special project on prostheses for partial amputations of the foot?

Morris: Yes.

Compere: The subject metal limbs outlined for us is all right. The extra job of aluminum for braces is a separate project.

Peterson: There is as much need for improvement in braces as in artificial limbs and that will be considered separately but probably also established at McGuire. We have determined a system for special built shoes which involves the setting up of ten special cast-making units in various hospitals. There is a school for enlisted men in progress now at the Boston Depot. The unit takes a perfect weight-bearing impression of the foot for a permanent last. The program will permit the Veterans' Administration to use the same lasts after the men are discharged. Among the 10 hospitals, 4 amputation centers, Walter Reed, Lawson, McCloskey and Bushnell will have these machines.

Allredge: It might be better to limit our project on Plastics in prostheses to the lower extremity though we have been doing quite a bit of work with celastics for the upper extremities. If we continue with the limb we are trying out now and try out fiber glass that's about all we could do for the present.

Holscher: We have been interested in hinged joints for wrists, elbows, etc., but I don't believe we have either the industrial engineers or personnel in our shop to carry that on to any degree of perfection. I do think there might be a project we could enter into and that is in making a moving picture reproduction of processing the patient through all the phases of the amputation program - in other words, one from which a professional visitor would get a true picture.

Peterson: Would this be considered a research problem?

Holscher: I think it would. After all, research depends on facts reached in the past. I think we should have a record of what we are doing now and what we will do in the future.

Renn: We are getting ready to send a directive out to various services to make films on various subjects.

Holscher: We already have an outline and I thought we could use that as a beginning.

Peterson: Would this be done by the Signal Corps?

Renn: Yes.

Holscher: We could bring in problems related to the upper and lower extremities and then show processing through the shop, etc., and then go to the newer centers where metal and plastic are used. There is one more problem. I call attention to a simple handbook on fitting principles. At the end of the war fitting principles could be set down with pictures, etc.

Peterson: That has been considered. Each center should put it down in voice recording and transcription, essential facts on fitting, with the least possible delay. However, I believe that much of what we prepare today may be obsolete in two years. If there are no other comments, we will adjourn the meeting until tomorrow, when we go to McGuire General Hospital.

MEETING ADJOURNED AT 5:20 P.M.

SECOND DAY OF AMPUTATION CONFERENCE
MCGUIRE GENERAL HOSPITAL, RICHMOND, VIRGINIA
2 August 1945

At 0730 three cars left Washington, D. C., with fifteen (15) Officers, arriving at McGuire General Hospital at 1030. The morning period was spent observing the new brace shop and the metal limbs being fitted. The conference convened at 1330 on the Amputation Section. The following additional officers attended the conference this date: Col. P. E. Duggins - Commanding Officer, Major Carlo Scuderi, Lt. Herbert Hanger, C.A.C.

PROSTHESES

Peterson: Col. Peterson asked Lt. Hanger to present his comments on aluminum limbs in view of his experience and to compare the aluminum with fiber limbs.

Hanger: I think the aluminum limb is just about as good as any finished limb. I see no difference between this type of limb

and the metal limb that you would buy from any civilian factory. There is no difference in the metal although there might be a slight difference in the socket material used between various manufacturers. We have been getting two types of limbs: 1. Davies and 2. Hanger. Davies limb is spun and worked up by hydraulic compression. The Hanger limb is formed from sheet metal. After painting you can't tell the difference. We have had a few things happen to them. We have had three of the ankle base jaws snap off at the base because of the bushing pin. This was caused by the hole being drilled through the base to accommodate the bushing locking pin. We have since received a base with another type of locking device. None of these have broken.

Peterson: I would like to see one that was broken and if you have a sample we would like to have it.

Hanger: I don't have any here. We welded those that were broken and patients are wearing them. We see no reason why the set screw type should cause a break in the casting. It seems like a satisfactory type of lock. Another source of trouble is the screw which clamps the jaw on the bushing. If these screws are tightened enough so that they will not work loose the ankle motion is too stiff. If a proper adjustment is made we have had many that have worked loose in two to three days.

Peterson: Every center should inspect these parts and if they find any that are unfit they should be returned.

Hanger: Most of the stock feet were too thin from instep to toe. There was hardly any room to fit the toe rubber. In a few cases when the patient had a large foot we had to construct a special artificial foot for him here in the shop. We should definitely have the proper size feet, but I think this one will stand up if rawhided. This is the kind of BK socket we have been using, (leather). The majority of centers have been using this molded leather socket. We are trying resin impregnated 1/8 inch, felt wrapped with some type of cloth. A quarter-inch collar was put on to hold it in position. I do not believe the wrapping is necessary. It entails an operation that takes quite a bit of time.

Myers: We have tried felt and we find it too brittle, but what we are using now is plain gauze because we find it is best.

Hanger: What kind of resin?

Myers: PPS 16 631 - thermoplastic type.

Peterson: Col. Myers at Bushnell has had more experience with plastic sockets than anyone else, I believe.

Hanger: There are many types of plastics. I think this one has great possibilities, if it is not too brittle. It would be much more simple to make a socket without using leather. I have ordered enough material to make about twenty plastic sockets and we are going to try them out.

I have asked Major Pirie to get me some of these Peoria BK joints with split lower section. This type of joint distributes the strain more evenly and has much more resistance to various strains. Although the present joint seems to stand up pretty well on fibre.

Peterson: We received a report this week from the Bureau of Standards on Joints submitted by several companies and they pointed out many imperfections. The problem is to find a manufacturer who will make joints according to our new specifications. Col. Myers do you have any trouble with them?

Myers: We got a few good ones and then they send me the old kind.

Peterson: If you get any that are inferior, you should send them back or send them to the Purchasing Office in N.Y. Do not use them if they are below standard specifications.

Hanger: Men working in this shop have told me that they find it very difficult to get a neat fit with the new joint because the joint is so hard that they can't bend it close to the head.

Peterson: Is it good or bad? We want hard metal and hard metal is hard to bend.

Hanger: The man who took the course at J. E. Hanger, told me they heated the joints to bend them and then nickel plated them afterward.

Peterson: If they heat too close to the joint, will it be damaged?

Hanger: Yes, that will damage it.

Peterson: Will your present joints fit, in your opinion?

Hanger: I think this kind of joint is all right.

Peterson: These specifications have been in effect since April. If you get a bad joint don't use it, send it back.

Cleveland: The British and French joints are different.

Peterson: I would like to arrange to have this group and the NRC committee see them.

Hanger: We usually let the patient wear this leg for a while and then finish it up before he is discharged. The AK container is welded to the knee.

Peterson: From your experience with this type of limb and the fiber limb, is it harder to fit the aluminum or the fiber?

Hanger: It takes more work to alter this one than the fiber type; however, the metal socket can be altered locally and it is almost impossible to alter a fiber socket. The only way you can do it is to take leather out or build up in a small area. I think that the separate AK socket as provided in the metal limb is definitely better. The only place you can fit the fiber socket is at the top. In the metal type you can follow the contour of the stump all the way down.

Peterson: How many present would say that the stump should be fitted all the way to the end and not just at the top?

Unanimous.

Peterson: How many present think we should use a separate socket in order to fit the AK Stump?

Unanimous.

Peterson: How many cases could be fitted properly with a one-piece socket?

Hanger: Not over 20%, if that many.

Peterson: Then 80% would benefit from a separate socket?

Hanger: In a metal BK limb you can readily alter the socket locally. In the fiber type when you have a long stump in a few cases the socket sticks out and you will have a very hard time making it fit even by soaking it in water. To fit the socket into a metal skin the metal can be stretched locally quite easily on the machine.

Peterson: How long does it take to release a point $\frac{1}{4}$ inch in depth?

Hanger: About a minute or less.

Peterson: How long would it take to make one of these metal limbs?

Hanger: The men tell me that it will take about a day, but I think that is a little optimistic.

Peterson: Could three men get it done in a day?

Hanger: Just about.

Comper: How did the weight turn out on the A.K. limbs weighted this morning?

Pirie: 6 pounds 8 ounces for the unpainted one without the shoe, 7 pounds $3\frac{1}{2}$ ounces on the one that had been finished. The fiber leg was 8 pounds 15 ounces or 1 pound 12 ounces more on the one sample available.

Myers: Where the ankle joint assembly is set into the wooden foot, the front wall is vertical while it should be sloped.

Peterson: Any comments on the rubber bumpers? We are not satisfied with the quality of rubber and have taken it up with several manufacturers.

Comper: I have a rubber bumper here that Lt. Hanger gave me and it is so hard that the patients do not like it because they say it feels like they are walking on wood.

Myers: There are some rubber conveyor belts that are just as resistant as metal. We have tried them out.

Peterson: Let us get some of them for trial. Are there any questions on the new knee assembly which we have seen exhibited?

Allredge: I would like to know if we can get knees supplied in $3\frac{1}{2}$ " size instead of 4".

Peterson: There will be both $3\frac{1}{2}$ " and 4" standard sizes. It just happens that 4" size is the first available.

Allredge: We would like to get some extra knees and ankles.

Peterson: You will receive them. Just put in request through AMPO New York.

Allredge: I have talked to patients in the prosthesis shop here and the psychological effect of the metal limbs is certainly good.

Hanger: I was very favorably impressed with the speed with which the work was done on this type of leg. Alterations can be done faster than in other legs and the legs are more permanent in nature.

Allredge: Referring to the AK hip joint, is that being placed laterally or anteriorly?

Hanger: Anteriorly.

McGaw: Lt. Hanger, can you train your men to use the metal as well as the other type limb?

Hanger: If you get a man who is adaptable to the work. As yet I think it is too early to tell, although I think it is just as easy to train a man to work with metal as with fiber or leather.

Alldredge: Does body perspiration affect the aluminum?

Hanger: Yes, after about three weeks time but by then it is protected by painting the aluminum which will take care of body perspiration.

Peterson: Col. Peterson then asked the group if they would like to have Mr. Gabbert, volunteer civilian amputee from Portland, Oregon, visit the centers again.

The answer was unanimous.

Peterson: Col. Peterson asked Col. Myers to arrange to have him appointed as a consultant for the next tours to facilitate his travel.

Myers: If he has the time to give to it I think it would be well.

AMPUTATION SURGERY

Peterson: We will first consider the question of complications and what should be reported as a complication. It is important that all centers arrive at the same conclusions and agree on this point since we get a monthly report from all centers. First: Are you all using penicillin routinely in all revisions, or only in those that have granulation tissue at the time of revision?

Compere: (McGuire General Hospital) We use penicillin in every case, beginning one (1) day before surgery and continuing five (5) days or longer postoperatively, usually 7 or 8 days.

Alldredge: (England General Hospital) We use it routinely on all operative cases, starting 24 hours before the operation and continuing for varying lengths of time, which we feel depends on the individual case, usually 6 to 7 days, sometimes 2 weeks.

McGaw: (Walter Reed General Hospital) Routinely, both preoperatively and postoperatively. We average 7 to 10 days postoperatively.

Myers: (Bushnell General Hospital) We use sulfadiazine routinely and penicillin in cases we suspect might be difficult. We use sulfadiazine 2 days preoperatively and until the sutures are removed postoperatively. We use penicillin in about 25% of the cases and we use it on all high thighs. One additional thing:

We use sulfasuxidine in the very high thigh cases which are so close to the anus, to try to sterilize the bowel content. There is one other comment on penicillin: There are several articles I have read about the bacteriostatic effect of penicillin, that it attacks only those organisms in the actively dividing state and that if you stop penicillin abruptly, you will miss a few organisms, whereas if you taper it off or repeat it, it is more effective. For example, there was a boy whose disorder was not evident while penicillin was used but which flared up again every time it was stopped. When the use of penicillin was tapered off at 4 and 7 hour intervals, it cleared up. Dermatologists believe intermittent therapy has perhaps more value than continuous and then abrupt cessation of therapy.

Peterson: Are you practising intermittent therapy?

Myers: Yes, we are now, but we have not yet formed an opinion.

Holscher: (Lawson General Hospital) We have never used penicillin routinely. Recently we have started using it in selected cases. We noticed that the stump complications were no greater in one case than the other. We use it now with febrile reactions; we do not use it as a prophylactic measure. We use penicillin only to treat febrile cases.

Morris: (McCloskey General Hospital) We have been using penicillin prophylactically only on granulating cases, starting 24 hours preoperatively and continuing 4 to 5 days, depending on the individual case.

Caldwell: (Percy Jones General Hospital) We are using sulfadiazine routinely in all stump cases, except in the cases where the individual operator feels he wants to use penicillin. We do not use penicillin prophylactically on any type of case.

Peterson: We have then three (3) hospitals, McGuire, England, and Walter Reed, using penicillin routinely in revision of all types of stumps; one hospital, Percy Jones, using sulfadiazine routinely in all stump revisions; another, Bushnell, in operating near areas previously infected; McCloskey using it only in granulating cases and Lawson not using any chemotherapy prophylactically. Is anyone using local applications of penicillin? In a recent meeting there was pretty general agreement that local applications of penicillin and sulfa drugs were of no value.

Cleveland: They only put it in serous cavities overseas. For local or systemic infections it was injected. Local application is of no value.

Compere: Do you mean in a fresh wound or in a granulating wound? I can't see how 250 units of penicillin locally could do any harm, and it certainly helps.

Cleveland: In the fresh wounds, sulfonamides are contraindicated, not of value, and harmful.

Peterson: Major Compere feels that local application of penicillin in granulating wounds is of benefit. Col. Myers, you apparently feel that prophylactic chemotherapy is of value. Do you feel that sulfadiazine is superior to penicillin?

Cleveland: (Orthopedic consultant ETO) When penicillin became available in quantity, shortly before D-day, we shot everyone full of penicillin and sulfadiazine. In a recent meeting a bacteriologist read a paper on the effect of these drugs used separately and in combination. He felt that sulfadiazine and penicillin used together were not nearly as effective as either one used alone, and that penicillin was better. The day has gone by when penicillin and sulfadiazine were regarded as "holy water" - where you just had to sprinkle it into the wound and the patient was quite safe. A good primary debridement of the wound is far more important than the drugs. Adequate primary surgery, all foreign bodies removed, wide longitudinal incisions, complete debridement and cleaning of the wound, and secondary closure are the essential things.

Peterson: Have you used penicillin or sulfadiazine in secondary closure?

Cleveland: So many wounds had not been adequately debrided, and we had to do secondary debridement; this was more important than any chemotherapy.

Shands: What about debridement for a gunshot wound with fracture - a penetrating wound through the buttock, with fragmentation of bone?

Cleveland: I would explore it thoroughly, remove all loose cartilage and bone, and all devitalized synovial tissue; try, if possible to close the capsule, and leave the wound open. A knee joint is better for this closure than a hip joint, but you can do it on the hip.

Peterson: Col. Myers, if you feel chemotherapy is indicated, why use sulfadiazine instead of penicillin?

Myers: I guess it's a hangover from the days when we were a penicillin center and we were supposed to use it only on vital cases.

Peterson: In the light of your present experience, is it your opinion that sulfadiazine is superior to penicillin for future use?

Myers: As far as the patient is concerned, there is a little advantage to using sulfadiazine.

Peterson: You mean from the standpoint of administering it - the patient's comfort? I raise this question because in the tropics they said penicillin was a life saver to them and superior to sulfadiazine since dehydration made the latter dangerous.

Myers: I think penicillin is superior and, with your permission, we will use it routinely.

Peterson: You do not need my permission. If you use chemotherapy, use the one you think is superior.

Caldwell: I think penicillin is probably superior. I give sulfadiazine routinely principally because of the patient's comfort.

Peterson: Are the hospitals using penicillin routinely finding any complaints of discomfort from the patients?

Compere: From time to time; some batches of penicillin are better than others. Some wards use novocaine with it, and it does no harm. On the whole, if it is routine, if they know it's coming, and that everyone gets it, there are no complaints.

Allredge: We had one batch which novocaine precipitated. After that, we stopped using novocaine, and have had very few complaints.

Peterson: We have three hospitals using penicillin routinely, one using it on special indication, one using a different type of chemotherapy routinely, and one using none routinely. Now, let us determine standards for reporting complications. If we could make actual definitions here, we could run controls, under a common basis for reporting complications. Our reports in the past have not been of sufficient value because of slightly different standards.

Cleveland: Are they having more complications in the stumps at Lawson General Hospital than other hospitals?

Holscher: We have been very interested in delayed healing but hematoma and flap necrosis have exceeded delayed wound healing due to gross infection. We feel that circulation was the real problem and that adequate excision of scar, with minimal trauma during operation, was more important than chemotherapy, just as Col. Cleveland brought out. Our incidence of the complications of all three types will run as high as other centers. We have made an effort during the last six months to get a report of any delayed wound healing. Last month the incidence of complications was only 8%.

- Peterson: Do you feel that the classification should be more detailed? I suggest that we count as a complication anything that definitely delays the recovery of the patient. How do you think the complications should be reported?
- Holscher: Gross infection should be reported; hematoma and necrosis should be reported in one category. The important thing we are trying to show is the instance of gross infection.
- Peterson: How do you define gross infection?
- Holscher: Appearance of exudate would be the determining sign. Sterile necrosis gives a febrile reaction. I do not think there is any mistake when you have an infected stump.
- Allredge: What we have done is to have routine standing orders for all surgeons to report in writing, every complication the day it occurs, starting with a hematoma, slough, or hematoma followed by infection, anything developing after the sutures are taken out, anything that delays wound healing, or that delays the fitting of a limb. They understand that this does not reflect on the surgery, and they have been good about reporting complications.
- McGaw: We interpret the item in various ways. In the past we have not reported all complications. I think we should define what we mean by primary healing. Anything not healed completely in 2 or 3 weeks has some complication. Even one stitch abscess or a little draining sinus is a very serious complication, as far as the patient is concerned.
- Cleveland: Why not revise the field and keep score of the other side - every amputation that heals per primam. Then you are getting the positive instead of dealing with the negative.
- Compere: The trouble with that approach is that you would have no breakdown of your complications.
- Allredge: If you report cases the first month that heal per primam, some of these will develop complications later.
- Peterson: If a sinus persists or reforms, are you all reporting it as a complication?
- McGaw: We have not been reporting it.
- Compere: A sinus means infections? We report that. We consider that it delays the fitting of prosthesis. I can hardly think of any other interpretation.
- Peterson: It is generally agreed that all sinuses should be reported as infections. The important thing is to be consistent.

- Compere: I think we should leave it just like it is, with 3 categories that interfere with healing. We could have an additional category for minor complications, such as stitch abscesses or a little minor wound necrosis.
- Peterson: That would make the classification 6 items instead of 3 as now, 3 major and 3 minor.
- McGaw: A time limit would help. I feel that in a wound which has not healed in 3 or 4 weeks something is wrong.
- Peterson: Three weeks is a fair limit for primary healing. In case any wound remains unhealed after 3 weeks, the Chief of Section should have a look at it. There will be more uniformity if the Chief of Section passes on it.
- Morris: I think so. I have them report complications the day they occur. They notify us about it and if anything serious is developing we catch it early.
- Peterson: I would like to see us arrive at some conclusion on chemotherapy. Let us say that we start on the 1st of September and run a test for 6 months - we should get some comparison. Each should establish a method of chemotherapy and be consistent in that for the next 6 months. If we all use the same method of reporting complications we will have a basis for comparison.
- McGaw: We felt that we might run 50 each, with and without penicillin, but then, the ward officers and surgeons felt it unfair to the other patients, so we finally ran only 17. We had one serious infection in the group that did not have penicillin, none in the group that did. Minor infections were much less frequent in the group having penicillin.
- Peterson: It's bad psychologically to run parallel series on penicillin in the same hospital. Walter Reed began a test because we requested them to do so. Col. Myers, Maj. Morris, Col. Holscher and Maj. Caldwell are not using it routinely and could very well set up a control on their wards. I will ask Maj. Caldwell to get the centers together, determine what system they will use, and collect some figures on it.
- Caldwell: Only for infection, not for hematoma or necrosis?
- Peterson: The four of you get together and agree on some system of prophylactic chemotherapy. Take all cases on all wards. Just divide all cases into two groups - those with and without. We will follow it from our office and correlate the findings.
- Shands: Is anyone in this group using chlorophyll or cloresium?

- Alldredge: We have a batch and used it on a few cases, but have no definite ideas as to its effectiveness.
- Peterson: The National Research Council investigated it and felt it was not effective.
- Shands: I believe their investigation is still in progress.
- Peterson: How many hospitals use subcutaneous suture of any kind? (Hands raised) Five hospitals: McGuire, McCloskey, Lawson, Bushnell, and Percy Jones are using subcutaneous sutures routinely. England and Walter Reed use only cutaneous sutures routinely.
- How many are using cotton or silk? Bushnell, McCloskey, McGuire, and Lawson are using cotton.
- Holscher: In our center it varies with the surgeon.
- Peterson: How many are using postoperative drainage as a policy? (Hands raised) All except Bushnell and Lawson make it a policy to drain stumps postoperatively.
- McGaw: One point which interests me in wound healing is the matter of circulation and ischemia. I feel that frequently we use pressure bandages which prevent hemorrhage but which may interfere with circulation and thus promote ischemia and delay healing. I feel that elastic bandaging is a very delicate procedure and that much of our delayed healing is due to ischemia.
- Alldredge: I think that there is a great deal to that idea of Col. McGaw's in that a lot of harm can come from using pressure bandage too tightly, particularly by some of the men beginning this type of work; it may result in damage to the flaps. But pressure bandage properly applied is excellent and should be used routinely to prevent hematoma formation. We use pressure bandage routinely and make a special point of applying it with great care so as not to restrict circulation.
- McGaw: In an article by Perkins he used no pressure at all - made quite a point of it. He took a large ABD bandage and adhesive tape - strapped that onto the leg. He feels that any bandage above the wound gives you some constriction of circulation, so he straps a pad on the leg below the knee. We have been using pressure dressing all along.
- Holscher: As far as plaster and pressure dressings are concerned, I think an amputation stump ought to be treated like any other orthopedic wound, like a tibial bone graft, for instance. There is the same problem of delayed healing. Complete rest for an adequate length of time - weeks and not days is an

important factor. This is hard to attain in our present system, and it is difficult to train new surgeons. We use enough compression to take up soft tissue slack.

McGaw: When I got to Walter Reed I knew very little about amputation wounds but I had a similar experience with our knees overseas. We used to put on a pressure bandage and leave it on for 10 to 12 days. Every once in a while we would come across a wound that was perfectly healed, or seemed to be, but when we took the stitches out it would pull apart. When we left the compression bandage on for only 3 or 4 days, just until we were sure hematoma would not develop, we were all impressed with the rapidity of healing.

Peterson: Do you all have the new type bandage for testing from the U.S. Rubber Company?

Myers: Bushnell did not have them when I left.

Allredge: Ours came in while you were there. The situation with the bandages is this: They are very good for the first 2 or 3 times - easily applied, grip well, stay on properly, and patients like them. After the second or third laundering they begin to become velvety on the surface, look more like wool, lose stretch and resiliency, and get so that, even before they begin to wear out, you can't put them on properly. They are definitely inferior to the former elastic bandage.

Shands: Could they be dry-cleaned, perhaps?

Peterson: They would hardly be practical, with the blood stains, etc.

Myers: We use plaster immobilization and elastic bandage underneath. There is a question I'd like to ask: In the ligation of the femoral artery for short amputation is it advisable to do sympathetic blocks, or even sympathectomy, to insure good circulation?

Cleveland: They won't be satisfied with the results they obtain. We haven't done many sympathectomies, we have done just the block. No one is convinced that it has accomplished anything.

Myers: I'm talking about the cases after the leg has been amputated assuming that femoral ligation was so high that the circulation is still impaired after amputation.

Cleveland: I would say that here you are back where you can do definitive surgery, and I see no reason for not doing a sympathectomy.

Caldwell: For the last 2 months, almost routinely, on the stumps in which the limbs have been lost because of vascular damage, we

have sent them to neurosurgery for sympathectomy before reversion. The final plastic revisions did a little better. But it is too early to say anything conclusive.

Peterson: Maj. Caldwell will you please try to keep records on them, preoperative and postoperatively. Find someone on your section who can analyze the findings and present a positive or negative answer to some of the questions. It is important and interesting material to collect. Gentlemen, a lot of good clinical material and important information is slipping thru our hands.

Holscher: Back to Col. Myers' question: Major Caldwell, was there any difficulty with healing before the sympathectomy?

Caldwell: The sympathectomies were done before revision was attempted.

Allredge: Please clarify what you want reported in the way of limbs fitted.

Peterson: "Limbs fitted," should be complete limbs fitted. Any modification should not be included. Will you all check your own shops to see that that is the policy.

Morris: If a leg is secured from a private agency, is that to be counted as a new leg fitted?

Peterson: No, you could not count it, as it wasn't fitted in your shop.

Caldwell: In the case of a soldier discharged to duty, in fitting him with an extra leg or in providing him with a permanent leg, can we do that in the shop?

Peterson: If he is entitled to an extra limb and if he wants one from the shop there is no reason you can't provide it. You can do anything you feel is indicated with the material you have as long as it will benefit the amputee.

Caldwell: From whom could they get a permanent type prosthesis?

Peterson: That is provided in WD Circular, 9 September 1944.

Holscher: Returning to physical problems in amputations recently we did 4 BK amputations on trench foot patients and developed 50% complications among those. The ward surgeons felt that we should definitely wait before we did reamputations. We took about 6 other patients and gave them 90-day furloughs. On investigation, the complications proved to be necrosis of the anterior flap. Primary union took place along the margin of the flaps; we could not say it was defective circulation. We got Col. Kraus from Camp Butner to come down. He did not think we are justified in delaying surgery, so we are going

ahead and doing them as if there were no complications. We have done no sympathectomies. If we did a sympathectomy in a vascular case, would it be advisable to do it immediately following surgery?

Peterson: You would probably want to do it preliminary to stump surgery as done at Percy Jones.

Myers: In one case of amputation due to gas infection, at revision surgery there was recurrence and we lost the knee. He was healed when he came to us, and there was a 4 - months interval between original amputation and the revision. It was virulent enough to have to do a guillotine AK. He had the usual sulfadiazine - no penicillin.

Cleveland: Do you invariably refer to the circular amputation as a guillotine amputation? "Guillotine" implies a chop. With the idea of a guillotine, or even circular amputation, you would not be able to close it with skin traction. I'm not trying to be captious - we had difficulty, in the theatres, with this conception.

Peterson: I think we should discard the word "guillotine" in favor of the words "open" or "circular."

Myers: This hasn't helped me any yet on the question of the case with recurrent gas gangrene.

Peterson: Do you think we should make a rule on one case?

Myers: Is the serum of any value?

Peterson: No. Penicillin is of questionable value. I think you did the right thing as far as time is concerned. We have no rule to meet your single case of recurrent gas infection and we should refrain from making one.

Holscher: Recently I circulated a questionnaire regarding the Syme amputation and some very interesting information came which might be disseminated among the group.

Peterson: Please keep the SGO informed of any questionnaires or ideas - send us a copy.

Caldwell: What about subperiosteal resection of the os calcis in Syme's amputation?

Holscher: Dr. Dale, in Toronto, uses it to control the soft tissue pad. He seems quite impressed with this technique.

Caldwell: Are you satisfied with the picture after subperiosteal dissection?

Allredge: I haven't seen any.

Peterson: The cases that have sharp dissection look a little cleaner in the x-ray than the cases with the subperiosteal resection, but they don't walk on the x-ray appearance. Both types seem to do well clinically. We will speak more about follow-up tomorrow.

There followed a discussion of improved specifications for bone plates and screws and opinions were submitted on the proposed changes. The conference adjourned at 1715 and the group returned to DC after dinner.

THIRD DAY OF AMPUTATION CONFERENCE SGO

3 August 1945

* * * * *

The following additional officers attended the conference this date:

Major General Norman T. Kirk	The Surgeon General
Colonel A. Love	SGO
Lt. Col. M. E. DeBakey	SGO
Major D. B. Slocum	Walter Reed General Hospital

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PLANS FOR THE HISTORY OF THE AMPUTATION PROGRAM

The Conference was called to order at 0915 and the day's program was briefly outlined by Col. Peterson.

Col. A. Love, Director, Historical Division, spoke on the need for an adequate history of the present war and the importance of historical records of past wars. He presented the general outline of the historical volumes with special reference to the Medical Department. Lt. Col. M. E. DeBakey, spoke on the plan for the history of Surgery in this war which is to be of interesting and narrative type. It is important to integrate the material from the theaters with material from the Zone of Interior. Changes in concepts, and techniques and development of prostheses will be especially important to record.

Morris: As questions come up from time to time, will we be able to communicate with you without going through several channels? We have certain questions which could best be handled directly with The Surgeon General's Office.

DeBakey: If purely a technical matter, you will be able to communicate directly.

Peterson: Do the officers present feel restricted in personal communication to this office on technical details? How many have been restricted in personal communication of this nature?

Officers from five of the centers represented felt they were handicapped by restriction on communications of a technical nature due to official directives.

Peterson: Col. DeBakey, we plan to direct these centers through channels to prepare a certain section on amputation history.

DeBakey: I think it will depend on your outline of the section on amputations and how you want it prepared. We feel, for example, that after one man has been given the responsibility of preparing a certain section on amputations, that the experience he writes will be through his own eyes and his own experience. It might not be adequate and might not portray the over-all picture. Therefore, it is desirable for him to have the help of other people who also have a certain amount of experience along the same line but whose experience may have been a little different. He may obtain the help of anyone he wishes and it would be desirable for him to obtain as much help as possible from various other sources. There will be sources available to us that won't be available to him. We want everyone to get credit for anything he contributes even if it is no more than reference. That is the common practice, of course, in the preparation of scientific material.

Peterson: Will authors names appear in the various sections?

DeBakey: Yes. Let me say that there is already a large amount of material available in this office for reference. You can use any material which you may prepare in publication later and perhaps even before publication of the history. There are no restrictions on the personal use of this material.

Slocum: Along that line, some of the centers, such as ours, are taking illustrations made by local artists as non-expendable property. Will those be available for use by the individual?

DeBakey: Yes. If you want to use the illustrations prepared by the Medical Department for your own personal use, you would have to have copies made at your own expense. Publication would have to be approved by the military authorities.

Slocum: The material could be loaned for that purpose.

Peterson: I think the Army is liberal on that point. You frequently see credit reference to the Medical Department in textbooks or manuscripts.

DeBakey: The general policy is to encourage publication of any personal material. While making every effort to get material published after the war, we are trying to get started on it now, by publication in various surgical journals. We are actually purchasing colored plates that are being made now for publication in journals which we feel will be desirable to use in our history.

Peterson: It is our plan, Colonel Love, to select certain subjects, and we will send from this office a letter to each center, requesting that a designated section of the amputation history be prepared by that hospital.

DeBakey: We are hoping that it might be possible to bring in some of the men after the end of the war for a period of temporary duty for the final preparation of the history.

Peterson: I don't know how else it can be done. The consultants are so busy, we need a special period of time to do this job well.

Love: Certainly that would be the most economical and advantageous way to do it. I hope we can get authority.

Peterson: I think it is important, gentlemen, even if not prepared to write a narrative, that you collect this material as quickly as possible, all illustrations, photographs and manuscripts which are available.

Slocum: I would like to ask about the matter of bibliography file. It is my impression that the history of the war of the Rebellion is a source book for bibliography; nothing existed before that--they traced back 150 years.

DeBakey: We aren't writing a review of all past experiences. We are primarily concerned with recording the history of this war, but there will be instances in the history where reference to previous experience will be pertinent. We aren't interested in the textbook style or reviewing thoroughly all the past experience on any subject.

Love: I am glad Major Slocum is acquainted with the history of the Civil War. We are in a little different position than people were then. At that time they had no previous medical history other than the Crimean War I referred to. It is important that you go back and study the history of World War I and of the Civil War period. It seems to me highly desirable to carry on where those two histories were left off.

DeBakey: To give a specific example how you might want to refer to previous experience. There was considerable controversy during the early part of the war on the thought of penetrating

wounds of the chest and foreign bodies. It had not quite crystallized and different individuals were expressing different opinions on management. Gradually opinion did crystallize and we began to feel it would be desirable to remove foreign bodies of a certain size and that it was difficult to return to duty an individual who still knew he had a foreign body in his chest. The concept developed to the realization that the individuals continued to complain when they knew the foreign bodies were in their chest, although the foreign body wasn't doing harm. The same sort of experience was recorded in the Civil War and it is described beautifully in that history, and the same conclusion was reached. It is interesting to see that we should go through the same experience and, second, it emphasizes the importance of knowing something about previous experience.

Peterson: You should therefore, review the history pertaining to your own section.

Cleveland: I am interested in the business of recording these facts. Probably, few here ever saw the history of World War I. Those volumes didn't appear until 1927, ten years after the declaration of war. During the early periods we were in training camps, we didn't know it existed. I wonder what we are gathering this for, to gather dust on the shelves or for our own satisfaction. Col. Brackett who edited the orthopedic section for World War I made a few observations which would have been extraordinarily helpful in this war, including, elective surgery on knees and feet. We had to learn those lessons all over again. It seems we are just chasing our tails. I am much more familiar with three green volumes of the Civil War which I own because I am more interested in the Civil War history than in World War I. It was never impressed on the present generation that anyone made important observations in World War I.

Peterson: It seems significant from the standpoint of the Regular Army, that in the basic course at the Army Medical Center and at Carlisle Barracks, no specific study was made of the history of the World War. I believe that a course on the Medical history of previous wars would have been a very important subject. I hope that in the future training of medical officers this will be given a more prominent part.

Love: The history has a wider distribution than is generally realized and it really has been used by certain people quite extensively although unfortunately it hasn't had as wide distribution as it should have had. It was deposited in all the principal libraries in the United States, Medical and Government. I think, as Col. Peterson has said, if we could use the volumes of history in our schools, that it would give it greater

publicity and extend its usefulness. Unfortunately many of the people in our schools, Army as well as civilian, are not historically minded and consequently, it is difficult to put this idea across. The value of the history depends upon what you gentlemen and your colleagues do with it. If you use it in your teaching or call it to the attention of your students, it will be known and will be used. If you don't call attention to it, it will rest on the shelves and be consulted only by a limited few who go after it.

- Peterson: There is some difficulty in assigning authors by name to this subject because of the change in personnel.
- DeBakey: The only way you can do that is for these individuals you assign to prepare that particular section and record the experience up to a point that they are still involved. Sooner or later the war will end and this experience which they recorded will be useful in the final preparation or they may be brought back for the final preparation.

(Specific subjects for assignment in the preparation of the history were discussed)

Preparation of the History of the Amputation Program.

- McGuire General Hospital, Richmond, Virginia
Emergency Surgery and Transportation Including Overseas Theaters.
- Bushnell General Hospital, Brigham City, Utah
Surgery and Prostheses Involving the Arm and Shoulder.
- Percy Jones General Hospital, Battle Creek, Michigan
Surgery and Prostheses Involving the Thigh and Hip.
- England General Hospital, Atlantic City, New Jersey
Surgery and Prostheses for Syme Amputations and Amputations Involving the Foot.
- Lawson General Hospital, Atlanta, Georgia
Motion Picture recording history and development of the amputation program and prosthetics. (Include surgery, prostheses and fitting)
- McCloskey General Hospital, Temple, Texas
Surgery and Prostheses Involving the Leg (Below Knee Exclusive of Syme Amputation)
- Walter Reed General Hospital, Washington, D. C.
Surgery and Prostheses Involving the Forearm and Hand.

PROSTHETIC PROBLEMS AND DEVELOPMENTS

- Myers: Several months ago Mr. Mike Nagy, of Northrop Aviation Company suggested the use of plastic material such as they were using in airplane manufacturing. The actual technique has been outlined in detail and sent to all centers. We have tried many kinds of fabric including felt and stockinet. We had ordinary gauze bandage cut in inch strips and wound spirally, much as one would wind a plaster of paris bandage around the extremity. Each layer is impregnated with the bakelite plastic material. The details of the process and curing are all contained in the written bulletin we have prepared. We are using a curing oven which is the standard dry sterilizer in the Medical supply catalogue. (Samples of the plastic sockets were demonstrated and descriptive literature was distributed to all representatives.) The plastic socket can readily be buffed without fuzziness, one objection to felt. If you want to sand it out in a particular area and it gets too thin, you can add material to this region a second time. One man made up 12 sockets in a day. It is, therefore, very easy to discard the socket and start a new one. We have men who have worn both leather and plastic sockets and they request plastic. (The technique and illustration were discussed in further detail)
- McGaw: Are they polished on the outside?
- Myers: This is the finished product.
- Peterson: Any breakage or cracking?
- Myers: Not since making them this way. When using other materials, we occasionally get a crack.
- Peterson: How much time do you think you save?
- Myers: I don't know, but there is an obvious difference.
- Allredge: Do they ever change shape?
- Myers: These do not. One difference between thermo plastic and this one which is thermo setting is that the latter does not change on heating. After this is set, it is set.
- Peterson: Col. Myers, have you yet or are you planning to write it up?
- Myers: Not any more than the description submitted.
- Peterson: This is a very important piece of research you have done.

Myers: The Syme prosthesis we are making of plastic has an integral foot without the ankle joint. We developed this to required thickness so we don't have trouble with breakage any more. The men like it. When we make a Syme prosthesis, we use muslin because it is cut on a bias and it has to be accurately lined since you can't change it after it is finished. All end-bearing amputees prefer a cushion effect for the end of the socket. Someone told us about flaxseed and we developed this little pad which is heated mildly and then it conforms quite accurately to the distal end of the stump. There is always a little oily surface to it and the knee bearings cases particularly like it. We have been using it recently on Symes cases. It is not a standard item--buy it at the local drug store.

Allredge: Is this Syme prosthesis made out of the same type of plastic as you use in the sockets for below knee limbs?

Myers: The same. We have made 8 or 10 Syme plastic prosthesis. There is another subject I want to mention. We have a good deal of difficulty in fitting the short forearm stumps with limited motion. Here is a picture of the range of motion in a short forearm stump and the range in motion after fitting with a joint that has the effect of multiplying the action elbow joint. This type of joint is used in cases with less than 90° elbow motion. You have to sacrifice lifting power but, the man who is wearing this type has elected to wear this in preference to the standard type and he uses the prosthesis vigorously.

Peterson: Is anyone making it commercially?

Myers: We are making it in our own shop. We probably could arrange for Hosmer Company to make it up.

Peterson: How many centers would like to have these special elbow joints? (Unanimous) We don't have a sample of the joint-- If you'll furnish a sample of that joint to Capt. White, we will arrange to have it manufactured.

Myers: Each center will need 10 or 12. It cannot be used on longer stumps because the bucket will stick out behind. It is intended only for a short below-elbow stump with limited range of motion, the others use the ordinary prosthesis.

Peterson: McCloskey has shop facilities at Waco. Major Morris will you see if you can get them made for all the centers until we may find a manufacturer to take it over. I think it is an excellent joint for these special cases.

Myers: There is need for a short cable attachment to be used with the Dorrance hook as an extension so that the hook and hand

can be readily interchanged. This should be 5 or 6 inches long.

Pirie: We can send them out as soon as they can be produced. We'll get on it right away.

Myers: Sometime ago an amputee came through the center with an elbow disarticulation received some 30 years ago. He had such good control of his prosthesis that we thought it a reasonable thing to try to fit a similar case. We have done it on three cases very satisfactorily. Mr. Vesper made 3 of these with an outside lock and bisected the forearm which is an added feature which some of the men like very much in driving and work. We mold a socket ourselves. It is being ordered as non-standard prosthesis. The chief advantage is that we have a longer upper arm stump and it is not so difficult to rotate the extremity. I think it is a worthwhile type of amputation, since you utilize a greater range of motion and more freedom than in the conventional arm stump.

McGaw: Does the flare of the condyles make it more effective.

Slocum: Don't you use it for a very short below-elbow stump as well as for a disarticulation?

Myers: Yes.

Peterson: Col. Myers, I want to be sure that everyone here knows what you are using in producing the plastic sockets and that they install the necessary facilities. This is urgent because Mr. Nagy is going around to all the centers within a few days as a consultant to demonstrate the technique.

Pirie: If Mr. Nagy is going around to the hospitals, won't it be disadvantageous for him to be there prior to arrival of this equipment?

Peterson: He is visiting a little sooner than I expected. Col. Myers, will he be able to do this work on a limited scale with the equipment which might be available in the centers now? They have a heating oven, etc. We shouldn't interrupt Mr. Nagy's visit providing we can get enough to have on hand at the time of his visit.

Pirie: Under those conditions, I would say yes, tentatively, Colonel, and I'll know the facts this afternoon.

Peterson: Col. Myers, when you return to Bushnell, please supply Nagy with enough to take to Percy Jones. We will rush a small supply to the other centers. After we get enough to start the demonstration, we will then supply a 6 months' quantity. Each center will immediately requisition the standard ovens.

We'll get the electric motors and the plastics and have them shipped.

- Holscher: What is the relative fire hazard? Should it be stored outside the shops?
- Myers: Part of it is inflammable material -- we have to store it in a safe place. Actually in the shop it is of no great hazard.
- Holscher: Is this method to supersede the fabrication of socket with leather or celastic?
- Peterson: This method is probably superior to either leather or celastic and I want every center to have the material and learn the technique. You will still need celastic and leather for certain things but encourage your shop to use the new method if it proves satisfactory.

Further discussion was resumed on the Research program as outlined on 1 August, the first day of the conference, and individual projects were reviewed.

A discussion was held on early secondary closure following open amputations overseas. Four of the amputation centers were definitely against early secondary closure because it was felt that at least 50% of cases seen which had been secondarily closed overseas had serious trouble with the stump, either a ring sequestrum sinus or infection of some other type. Three amputation centers were favorably impressed with early secondary closure in selected cases, but were opposed to a general policy of early secondary closure. Colonel Cleveland felt that early secondary closure was contraindicated because of further loss of stump length which would result in an effort to obtain skin to effect closure.

General Kirk joined the conference at 1500. He felt that early secondary closure should not be the policy because revision is still required later, thus necessitating three (3) operations for the patient where only two (2) are otherwise required, that is the primary guillotine and later revision. He also stated that overseas traction should be more effective using rubber traction cords with careful application.

Major Compere suggested that cases coming in from overseas in traction had not had necessary adjustments along the way, consequently, the traction was not effective on arrival at the amputation centers.

Colonel Peterson emphasized the importance of conserving skin in the open amputation so that closure would be produced by effective traction. In selected cases, especially where evacuation might be delayed, secondary closure should be permitted. Skin grafting should not be substituted for traction and should only be done after the maximum

benefit of traction has been obtained, usually in preparation for revision.

General Kirk stated that the centers had done a fine job in the surgery, fitting, and training of the large number of amputees and he congratulated the officers present on their contribution.

The conference adjourned 1530.

